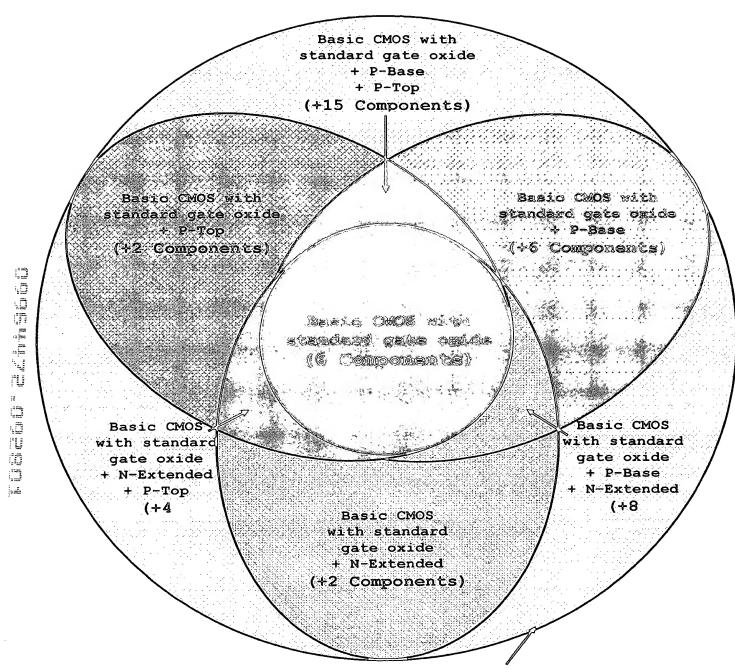
Name of Photolithographic Mask	Process Steps
Mask 1: N-Well	Starting Material : P- Bulk Silicon
Mask I. N-Well	Oxidation (Initial oxide)
	Photo
 -	N-Type Implant (N-Well)
 -	Diffusion
Mask 2: Active Area	Oxide Etch
Mask 2. Active Alea	Oxidation (Subnitox)
 	Silicon Nitride Deposition (CVD)
-	Photo
<u> </u>	
	Nitride Etch
Mask 3: P-Field	Photo
<u>_</u>	P-Type Implant (P-Field)
<u> </u>	Blanket N-Type Implant (N-Field)
<u>L</u>	Oxidation (Field Oxide)
L	Nitride Etch
L	Oxide Etch
	Oxidation (Pre-Gate Oxide)
Mask 5: VTP Adjust	Oxide Etch
	Oxidation (Gate Oxide)
	Photo
	P-Type Implant (VTP Adjust)
Mask 6: Polysilicon Gate Patterning	Polysilicon Gate Deposition (CVD)
	Polysilicon Doping
	Photo
	Polysilicon Etch
Mask 10: N+ Implant	Oxidation and Diffusion
·	Polysilicon Oxidation
	Photo
	N-Type Implant (N+)
Mask 11: P+ Implant	Photo
	P-Type Implant (P+)
Mask 12: Contacts	SG/PSG/SOG (Oxide) Deposition
	Diffusion
	Photo
 -	Contact Etch
Mask 13: Metal 1	Ti/TiN Deposition with Oxidation
Mask 13. Metal 1	Aluminium Alloy Deposition
-	Photo
	Metal Etch
<u> </u>	
	Dielectric and SOG (Oxide) Deposition
Mask 14: Vias	Photo
	Vias Etch
Mask 15: Metal 2	Ti/TiN Deposition with Oxidation
<u> </u>	Aluminium Alloy Deposition
	Photo
<u></u>	Metal Etch
	Oxide / Nitride Deposition
Mask 16: Passivation	Photo
i	Oxide Etch



Basic CMOS with standard gate oxide + P-Base + N-Extended + P-Top

Name of Photolithographic Mask	Process Steps
Mask 1: N-Well	Starting Material : P- Bulk Silicon
	Oxidation (Initial oxide)
	Photo
	N-Type Implant (N-Well)
	Diffusion
Mask 2: Active Area	Oxide Etch
	Oxidation (Subnitox)
	Silicon Nitride Deposition (CVD)
	Photo
•	Nitride Etch
Mask 3: P-Field	Photo
145% 5. 1 11614	P-Type Implant (P-Field)
	Blanket N-Type Implant (N-Field)
	Oxidation (Field Oxide)
	Nitride Etch
	Oxide Etch
· · · · · · · · · · · · · · · · · · ·	Oxidation (Pre-Gate Oxide)
Mask 5: Thin Gate oxide & VTP Adjust	Oxide Etch
	, Oxidation (Thin Gate Oxide)
	Photo
	P-Type Implant (VTP Adjust)
Mask 6: Polysilicon Gate Patterning	Polysilicon Gate Deposition (CVD)
	Polysilicon Doping
	Photo
	Polysilicon Etch
Mask 8: N-Extended	Photo
	N-Type: Implant (N-Extended)
Mask 10: N+ Implant	Oxidation and Diffusion
	Polysilicon Oxidation
	Photo
	N-Type Implant (N+)
Mask 11: P+ Implant	Photo
	P-Type Implant (P+)
Mask 12: Contacts	SG/PSG/SOG (Oxide) Deposition
	Diffusion
	Photo
	Contact Etch
Mask 13: Metal 1	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
	Photo
	Metal Etch
	Dielectric and SOG (Oxide) Deposition
Mask 14: Vias	Photo
imun zt. Taus	Vias Etch
Mask 15: Metal 2	Ti/TiN Deposition with Oxidation
Mask 15. Metal 2	Aluminium Alloy Deposition
	Photo
	Metal Etch
	Oxide / Nitride Deposition
Mask 16: Passivation	Photo
	Oxide Etch

\$150 ST 100 ST 1	
Name of Photolithographic	Process Steps
Mask	
Mask 1: N-Well	Starting Material : P- Bulk Silicon
	Oxidation (Initial oxide)
	Photo
	N-Type Implant (N-Well)
	Diffusion
Mask 2: Active Area	Oxide Etch
	Oxidation (Subnitox)
	Silicon Nitride Deposition (CVD)
	Photo
	Nitride Etch
Mask 3: P-Field	Photo
	P-Type Implant (P-Field)
	Blanket N-Type Implant (N-Field)
	Oxidation (Field Oxide)
	Nitride Etch
	Oxide Etch
	Oxidation (Pre-Gate Oxide)
Mask 5: Thin Gate oxide & VTP Adjust	Oxide Etch
1	Oxidation (Thin Gate Oxide)
	Photo
	P-Type Implant (VTP Adjust)
Mask 6: Polysilicon Gate Patterning	Polysilicon Gate Deposition (CVD)
	Polysilicon Doping
	Photo
	Polysilicon Etch
Mask 9: P-Top	Photo
	P-Type Implant (P-Top)
Mask 10: N+ Implant	Oxidation and Diffusion
	Polysilicon Oxidation
	Photo
	N-Type Implant (N+)
Mask 11: P+ Implant	Photo
	P-Type Implant (P+)
Mask 12: Contacts	SG/PSG/SOG (Oxide) Deposition
	Diffusion
	Photo
	Contact Etch
Mask 13: Metal 1	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
	Photo
	Metal Etch
N1-4 A	Dielectric and SOG (Oxide) Deposition
Mask 14: Vias	Photo
March 4P. Ac. 1 A	Vias Etch
Mask 15: Metal 2	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
	Photo
	Metal Etch
V-1-16. B	Oxide / Nitride Deposition
Mask 16: Passivation	Photo Oxide Etch
	Uxide Etch

Name of Photolithographic Mask	Process Steps
Mask 1: N-Well	Starting Material : P- Bulk Silicon ,
	Oxidation (Initial oxide)
	Photo
	N-Type Implant (N-Well)
	Diffusion
Mask 2: Active Area	Oxide Etch
	Oxidation (Subnitox)
	Silicon Nitride Deposition (CVD)
ļ	Photo
i -	
Mask 3: P-Field	Nitride Etch
Mask 3: P-FleId	Photo
· ·	P-Type Implant (P-Field)
· ·	Blanket N-Type Implant (N-Field)
<u></u>	Oxidation (Field Oxide)
	Nitride Etch
	Oxide Etch
	Oxidation (Pre-Gate Oxide)
Mask 5: Thin Gate oxide & VTP Adjust	Oxide Etch
	Oxidation (Thin Gate Oxide)
	Photo
	P-Type Implant (VTP Adjust)
Mask 6: Polysilicon Gate Patterning	Polysilicon Gate Deposition (CVD)
	Polysilicon Doping
	Photo
	Polysilicon Etch
Mask 8: N-Extended	Photo
	N-Type Implant (N-Extended)
	Photo
- Carrier Control of the Control of	P-Type Implant (P-Top)
Mask 10: N+ Implant	Oxidation and Diffusion
Mask 10. N+ implant	Polysilicon Oxidation
<u> </u>	
ļ	Photo
	N-Type Implant (N+)
Mask 11: P+ Implant	Photo
	P-Type Implant (P+)
Mask 12: Contacts	SG/PSG/SOG (Oxide) Deposition
	Diffusion
	Photo
	Contact Etch
Mask 13: Metal 1	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
	Photo
	Metal Etch
· . —	Dielectric and SOG (Oxide) Deposition
Mask 14: Vias	Photo
	Vias Etch
Mask 15: Metal 2	Ti/TiN Deposition with Oxidation
ridsk 13. rie cul L	Aluminium Alloy Deposition
·	Photo
·	Metal Etch
ļ	
	Oxide / Nitride Deposition
Mask 16: Passivation	Photo
ļ	Oxide Etch

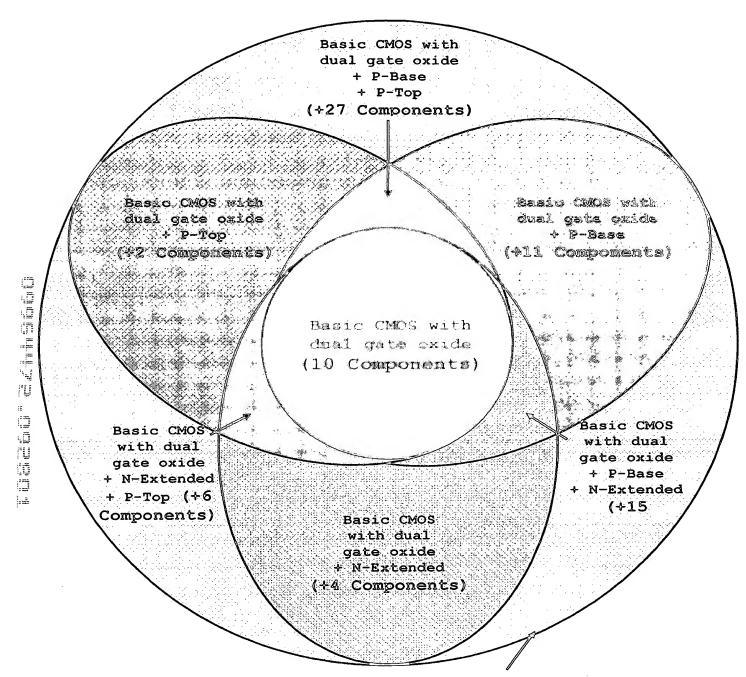
Name of Photolithographic Mask	Process Steps
Mask 1: N-Well	Starting Material : P- Bulk Silicon
	Oxidation (Initial oxide)
	Photo
	N-Type Implant (N-Well)
	Diffusion
Mask 2: Active Area	Oxide Etch
ndon 2. nctive nied	Oxidation (Subnitox)
	Silicon Nitride Deposition (CVD)
	Photo
	Nitride Etch
Mask 3: P-Field	Photo
Mak J. Fifeid	P-Type Implant (P-Field)
13.	Blanket N-Type Implant (N-Field)
	Oxidation (Field Oxide)
	Nitride Etch
	Oxide Etch
'	
	Oxidation (Pre-Gate Oxide)
Mask 5: Thin Gate oxide & VTP Adjust	Oxide Etch
	Oxidation (Thin Gate Oxide)
	Photo
and the second of the second o	P-Type Implant (VTP Adjust)
Mask 6: Polysilicon Gate Patterning	Polysilicon Gate Deposition (CVD)
	Polysilicon Doping
	Photo
	Polysilicon Etch
Mask 7: P-Base	Photo
	P-Type Implant (P-Base)
Mask 10: N+ Implant	Oxidation and Diffusion
	Polysilicon Oxidation
,	Photo
	N-Type Implant (N+)
Mask 11: P+ Implant	Photo
	P-Type Implant (P+)
Mask 12: Contacts	SG/PSG/SOG (Oxide) Deposition
	Diffusion
	Photo
	Contact Etch
Mask 13: Metal 1	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
	Photo
	Metal Etch
	Dielectric and SOG (Oxide) Deposition
Mask 14: Vias	Photo
	Vias Etch
Mask 15: Metal 2	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
	Photo
	Metal Etch
	Oxide / Nitride Deposition
Mask 16: Passivation	Photo
	Oxide Etch

Name of Photolithographic Mask	Process Steps
Mask 1: N-Well	Starting Material : P- Bulk Silicon
	Oxidation (Initial oxide)
	Photo
	N-Type Implant (N-Well)
	Diffusion
Mask 2: Active Area	Oxide Etch
	Oxidation (Subnitox)
	Silicon Nitride Deposition (CVD)
	Photo
	Nitride Etch
Mask 3: P-Field	Photo
	P-Type Implant (P-Field)
	Blanket N-Type Implant (N-Field)
i i	Oxidation (Field Oxide)
	Nitride Etch
	Oxide Etch
	Oxidation (Pre-Gate Oxide)
Mask 5: Thin Gate oxide & VTP Adjust	Oxide Etch
THOSE S. THEN COOK CALCO G VII HOJOUC	Oxidation (Thin Gate Oxide)
	Photo
	P-Type Implant (VTP Adjust)
Mask 6: Polysilicon Gate Patterning	Polysilicon Gate Deposition (CVD)
Mask 6. Polysilicon Gate Patterning	Polysilicon Doping
	Photo
	Polysilicon Etch
Mask 7: P. Base	Photo
mask / E-Dese	P-Type Implant (P-Base)
Mask 8: N-Extended	Photo
	N-Type Implant (N-Extended)
Mask 10: N+ Implant	Oxidation and Diffusion
	Polysilicon Oxidation
	Photo
	N-Type Implant (N+)
Mask 11: P+ Implant	Photo
	P-Type Implant (P+)
Mask 12: Contacts	SG/PSG/SOG (Oxide) Deposition
	Diffusion
	Photo
	Contact Etch
Mask 13: Metal 1	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
	Photo
	Metal Etch
	Dielectric and SOG (Oxide) Deposition
Mask 14: Vias	Photo
	Vias Etch
Mask 15: Metal 2	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
	Photo
 	Metal Etch
	Oxide / Nitride Deposition
Mask 16: Passivation	Photo
	Oxide Etch

Name of Photolithographic	Process Steps
Mask	
Mask 1: N-Well	Starting Material : P- Bulk Silicon
	Oxidation (Initial oxide)
	Photo
	N-Type Implant (N-Well)
	Diffusion
Mask 2: Active Area	Oxide Etch
1	Oxidation (Subnitox)
	Silicon Nitride Deposition (CVD)
	Photo
	Nitride Etch
Mask 3: P-Field	Photo
1.43% 3. 1 11614	P-Type Implant (P-Field)
	Blanket N-Type Implant (N-Field)
	Oxidation (Field Oxide)
	Nitride Etch
	Oxide Etch
· ·	Oxidation (Pre-Gate Oxide)
Mask 5: Thin Gate oxide & VTP Adjust	Oxide Etch
Mask 5. Inin Gate Oxide a VIF Rujust	Oxidation (Thin Gate Oxide)
	Photo
	P-Type Implant (VTP Adjust)
Mask 6: Polysilicon Gate Patterning	Polysilicon Gate Deposition (CVD)
mask 6: Polysilicon Gate Patterning	Polysilicon Doping
	Photo
	Polysilicon Etch
Mask 7: P-Base	Photo
MASA /: E DASW	P-Type Implant (P-Base)
Mask 9: P-Top	Photo
MASK 3, F-10P	P-Type Implant (P-Top)
Mask 10: N+ Implant	Oxidation and Diffusion
Mask 10. N+ Implant	Polysilicon Oxidation
	Photo
	N-Type Implant (N+)
Mask 11: P+ Implant	Photo
mask II: P+ Implant	P-Type Implant (P+)
Mask 12: Contacts	SG/PSG/SOG (Oxide) Deposition
mask 12: Contacts	Diffusion
	Photo
	Contact Etch
Mask 13: Metal 1	Ti/TiN Deposition with Oxidation
Mask 13: Metal 1	Aluminium Alloy Deposition
	Photo
	Metal Etch
	Dielectric and SOG (Oxide) Deposition
Mask 14: Vias	Photo
Mask 14: Vias	Vias Etch
Mask 15: Metal 2	Ti/TiN Deposition with Oxidation
mask 15: Metal 2	Aluminium Alloy Deposition
	Photo
	Metal Etch
No. 1 16 President	Oxide / Nitride Deposition Photo
Mask 16: Passivation	
	Oxide Etch

Name of Photolithographic Mask	Process Steps
Mask 1: N-Well	Starting Material : P- Bulk Silicon
	Oxidation (Initial oxide)
	Photo
	N-Type Implant (N-Well)
	Diffusion
Mask 2: Active Area	Oxide Etch
	Oxidation (Subnitox)
}	Silicon Nitride Deposition (CVD)
	Photo
	Nitride Etch
Mask 3: P-Field	Photo
	P-Type Implant (P-Field)
	Blanket N-Type Implant (N-Field)
	Oxidation (Field Oxide)
	Nitride Etch
	Oxide Etch
	Oxidation (Pre-Gate Oxide)
Mask 5: Thin Gate oxide & VTP Adjust	Oxide Etch
	Oxidation (Thin Gate Oxide)
	Photo
	P-Type Implant (VTP Adjust)
Mask 6: Polysilicon Gate Patterning	Polysilicon Gate Deposition (CVD)
	Polysilicon Doping
•	Photo
	Polysilicon Etch
Mask 7: P-Base	Photo
	P-Type Implant (P-Base)
Mask 8: N-Extended	Photo
	N-Type Implant (N-Extended)
Mask 9: P-Top	- Photo
	P-Type Implant (P-Top)
Mask 10: N+ Implant	Oxidation and Diffusion
	Polysilicon Oxidation
•	Photo
	N-Type Implant (N+)
Mask 11: P+ Implant	Photo
_	P-Type Implant (P+)
Mask 12: Contacts	SG/PSG/SOG (Oxide) Deposition
	Diffusion
	Photo
	Contact Etch
Mask 13: Metal 1	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
	Photo
	Metal Etch
	Dielectric and SOG (Oxide) Deposition
Mask 14: Vias	Photo
	Vias Etch
Mask 15: Metal 2	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
	Photo
	Metal Etch
	Oxide / Nitride Deposition
Mask 16: Passivation	Photo
Mask IV. Fassivacion	Oxide Etch
	0.120 2001

Figure 10



Basic CMOS with dual gate oxide + P-Base + N-Extended + PTop

Name of Photolithographic Mask	Process/Steps
Mask 1: N-Well	Starting Material : P- Bulk Silicon
	Oxidation (Initial oxide)
	Photo
	N-Type Implant (N-Well)
	Diffusion
Mask 2: Active Area	Oxide Etch
Mask 2. Active Alea	
	Oxidation (Subnitox)
	Silicon Nitride Deposition (CVD)
	Photo
	Nitride Etch
Mask 3: P-Field	Photo
'	P-Type Implant (P-Field)
·	Blanket N-Type Implant (N-Field)
	Oxidation (Field Oxide)
	Nitride Etch
	Oxide Etch
4. A	Oxidation (Pre-Gate Oxide)
Mask 4: High-voltage Gate Oxide	Oxide Etch
	Oxidation (High-voltage Gate Oxide)
The state of the s	Photo
Mask 5: Thin Gate oxide & VTP Adjust	Oxide Etch
	Oxidation (Thin Gate Oxide)
	Photo
	P-Type Implant (VTP Adjust)
Mask 6: Polysilicon Gate Patterning	Polysilicon Gate Deposition (CVD)
•	Polysilicon Doping
	Photo
	Polysilicon Etch
Mask 10: N+ Implant	Oxidation and Diffusion
-	Polysilicon Oxidation
	Photo
	N-Type Implant (N+)
Mask 11: P+ Implant	Photo
INION II. I I Implant	P-Type Implant (P+)
Mask 12: Contacts	SG/PSG/SOG (Oxide) Deposition
Mask 12: Contacts	Diffusion
	Photo
	Contact Etch
Mask 13: Metal 1	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
	Photo •
	Metal Etch
	Dielectric and SOG (Oxide) Deposition
Mask 14: Vias	Photo
	Vias Etch
Mask 15: Metal 2	Ti/TiN Deposition with Oxidation
and the state of t	Aluminium Alloy Deposition
	Photo
•	Metal Etch
	Oxide / Nitride Deposition
Mask 16: Passivation	Photo
	Oxide Etch

Name of Photolithographic	Process Steps
Mask	
Mask 1: N-Well	Starting Material : P- Bulk Silicon
	Oxidation (Initial oxide)
	Photo
	N-Type Implant (N-Well)
	Diffusion
Mask 2: Active Area	Oxide Etch
	Oxidation (Subnitox)
	Silicon Nitride Deposition (CVD)
	Photo
	Nitride Etch
Mask 3: P-Field	Photo
	P-Type Implant (P-Field)
	Blanket N-Type Implant (N-Field)
	Oxidation (Field Oxide)
	Nitride Etch
	Oxide Etch
	Oxidation (Pre-Gate Oxide)
Mask 4: High-voltage Gate Oxide	Oxide Etch
	Oxidation (High-voltage Gate Oxide)
CALL IC.	Photo Photo
Mask 5: Thin Gate oxide & VTP Adjust	Oxide Etch
	Oxidation (Thin Gate Oxide)
	Photo
	P-Type Implant (VTP Adjust)
Mask 6: Polysilicon Gate Patterning	Polysilicon Gate Deposition (CVD)
	Polysilicon Doping
	Photo
	Polysilicon Etch
Mask 9: P-Top	Photo
	P-Type Implant (P-Top)
Mask 10: N+ Implant	Oxidation and Diffusion
	Polysilicon Oxidation
	Photo
	N-Type Implant (N+)
Mask 11: P+ Implant	Photo
	P-Type Implant (P+)
Mask 12: Contacts	SG/PSG/SOG (Oxide) Deposition
1	Diffusion
	Photo
	Contact Etch
Mask 13: Metal 1	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
[Photo
	Metal Etch
	Dielectric and SOG (Oxide) Deposition
Mask 14: Vias	Photo
Name of the second second	Vias Etch
Mask 15: Metal 2	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
	Photo
	Metal Etch
	Oxide / Nitride Deposition
Mask 16: Passivation	Photo
	Oxide Etch

Name of Photolithographic	Process Steps
Mask	
Mask 1: N-Well	Starting Material : P- Bulk Silicon
Mask I. N-Well	Oxidation (Initial oxide)
	Photo
	N-Type Implant (N-Well)
	Diffusion
Mask 2: Active Area	Oxide Etch
	Oxidation (Subnitox)
1	Silicon Nitride Deposition (CVD)
·	Photo
Į į	Nitride Etch
Mask 3: P-Field	Photo
	P-Type Implant (P-Field)
	Blanket N-Type Implant (N-Field)
	Oxidation (Field Oxide)
Į į	Nitride Etch
· · · · · · · · · · · · · · · · · · ·	Oxide Etch
	Oxidation (Pre-Gate Oxide)
Mask 4: High-voltage Gate Oxide	Oxide Etch
	Oxidation (High-voltage Gate Oxide)
	Photo
Mask 5: Thin Gate oxide & VTP Adjust	Oxide Etch
	Oxidation (Thin Gate Oxide)
<u> </u>	Photo
<u> </u>	P-Type Implant (VTP Adjust)
Mask 6: Polysilicon Gate Patterning	Polysilicon Gate Deposition (CVD)
	Polysilicon Doping
j	Photo
	Polysilicon Etch
Mask 8: N-Extended	Photo Photo
	N-Type Implant (N-Extended)
Mask 10: N+ Implant	Oxidation and Diffusion
	Polysilicon Oxidation
	Photo
ļ t	N-Type Implant (N+)
Mask 11: P+ Implant	Photo
·	P-Type Implant (P+)
Mask 12: Contacts	SG/PSG/SOG (Oxide) Deposition
ļ	Diffusion Diffusion
ļ	Photo
, · · · · · · · · · · · · · · · · · · ·	Contact Etch
Mask 13: Metal 1	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
.	Photo
 	Metal Etch
 	Dielectric and SOG (Oxide) Deposition
Mask 14: Vias	Photo
ŀ	Vias Etch
Mask 15: Metal 2	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
ŀ	Photo
	Metal Etch
` <u> </u>	Oxide / Nitride Deposition
Mask 16: Passivation	Photo
<u> </u>	Oxide Etch
<u> </u>	

Name of Photolithographic **	Process Steps
Mask	
Mask 1: N-Well	Starting Material : P- Bulk Silicon
	Oxidation (Initial oxide)
	Photo
	N-Type Implant (N-Well)
	Diffusion
Mask 2: Active Area	Oxide Etch
	Oxidation (Subnitox)
	Silicon Nitride Deposition (CVD)
	Photo
	Nitride Etch
Mask 3: P-Field	Photo
	P-Type Implant (P-Field)
	Blanket N-Type Implant (N-Field)
	Oxidation (Field Oxide)
	Nitride Etch
	Oxide Etch
	Oxidation (Pre-Gate Oxide)
Mask 4: High-voltage Gate Oxide	Oxide Etch
	Oxidation (High-voltage Gate Oxide)
	Photo
Mask 5: Thin Gate oxide & VTP Adjust	Oxide Etch
	Oxidation (Thin Gate Oxide)
	Photo
	P-Type Implant (VTP Adjust)
Mask 6: Polysilicon Gate Patterning	Polysilicon Gate Deposition (CVD)
	Polysilicon Doping
	Photo
	Polysilicon Etch
Mask 8: N-Extended	Photo
	N-Type Implant (N-Extended)
Mask 9: P-Top	Photo
	P-Type Implant (P-Top)
Mask 10: N+ Implant	Oxidation and Diffusion
	Polysilicon Oxidation
	Photo
	N-Type Implant (N+)
Mask 11: P+ Implant	Photo
	P-Type Implant (P+)
Mask 12: Contacts	P-Type Implant (P+) SG/PSG/SOG (Oxide) Deposition
Mask 12: Contacts	
Mask 12: Contacts	SG/PSG/SOG (Oxide) Deposition
	SG/PSG/SOG (Oxide) Deposition Diffusion
Mask 12: Contacts Mask 13: Metal 1	SG/PSG/SOG (Oxide) Deposition Diffusion Photo
	SG/PSG/SOG (Oxide) Deposition Diffusion Photo Contact Etch
	SG/PSG/SOG (Oxide) Deposition Diffusion Photo Contact Etch Ti/TiN Deposition with Oxidation
	SG/PSG/SOG (Oxide) Deposition Diffusion Photo Contact Etch Ti/TiN Deposition with Oxidation Aluminium Alloy Deposition
Mask 13: Metal 1	SG/PSG/SOG (Oxide) Deposition Diffusion Photo Contact Etch Ti/TiN Deposition with Oxidation Aluminium Alloy Deposition Photo
	SG/PSG/SOG (Oxide) Deposition Diffusion Photo Contact Etch Ti/TiN Deposition with Oxidation Aluminium Alloy Deposition Photo Metal Etch
Mask 13: Metal 1	SG/PSG/SOG (Oxide) Deposition Diffusion Photo Contact Etch Ti/TiN Deposition with Oxidation Aluminium Alloy Deposition Photo Metal Etch Dielectric and SOG (Oxide) Deposition
Mask 13: Metal 1	SG/PSG/SOG (Oxide) Deposition Diffusion Photo Contact Etch Ti/TiN Deposition with Oxidation Aluminium Alloy Deposition Photo Metal Etch Dielectric and SOG (Oxide) Deposition Photo
Mask 13: Metal 1 Mask 14: Vias	SG/PSG/SOG (Oxide) Deposition Diffusion Photo Contact Etch Ti/TiN Deposition with Oxidation Aluminium Alloy Deposition Photo Metal Etch Dielectric and SOG (Oxide) Deposition Photo Vias Etch
Mask 13: Metal 1 Mask 14: Vias	SG/PSG/SOG (Oxide) Deposition Diffusion Photo Contact Etch Ti/TiN Deposition with Oxidation Aluminium Alloy Deposition Photo Metal Etch Dielectric and SOG (Oxide) Deposition Photo Vias Etch Ti/TiN Deposition with Oxidation
Mask 13: Metal 1 Mask 14: Vias	SG/PSG/SOG (Oxide) Deposition Diffusion Photo Contact Etch Ti/TiN Deposition with Oxidation Aluminium Alloy Deposition Photo Metal Etch Dielectric and SOG (Oxide) Deposition Photo Vias Etch Ti/TiN Deposition with Oxidation Aluminium Alloy Deposition
Mask 13: Metal 1 Mask 14: Vias	SG/PSG/SOG (Oxide) Deposition Diffusion Photo Contact Etch Ti/TiN Deposition with Oxidation Aluminium Alloy Deposition Photo Metal Etch Dielectric and SOG (Oxide) Deposition Photo Vias Etch Ti/TiN Deposition with Oxidation Aluminium Alloy Deposition Photo Photo Photo Photo Photo
Mask 13: Metal 1 Mask 14: Vias	SG/PSG/SOG (Oxide) Deposition Diffusion Photo Contact Etch Ti/TiN Deposition with Oxidation Aluminium Alloy Deposition Photo Metal Etch Dielectric and SOG (Oxide) Deposition Photo Vias Etch Ti/TiN Deposition with Oxidation Aluminium Alloy Deposition Photo Metal Etch Dielectric August Etch Ti/Tin Deposition with Oxidation Aluminium Alloy Deposition Photo Metal Etch

Name of Photolithographic	Process Steps
Mask	
The state of the s	
Mask 1: N-Well	Starting Material : P- Bulk Silicon
	Oxidation (Initial oxide)
·	Photo
<u> </u>	N-Type Implant (N-Well)
	Diffusion
Mask 2: Active Area	Oxide Etch
<u> </u>	Oxidation (Subnitox)
_	Silicon Nitride Deposition (CVD)
<u> </u>	Photo
	Nitride Etch
Mask 3: P-Field	Photo
<u></u>	P-Type Implant (P-Field)
<u> </u>	Blanket N-Type Implant (N-Field)
<u></u>	Oxidation (Field Oxide)
	Nitride Etch
	Oxide Etch
	Oxidation (Pre-Gate Oxide)
	Oxide Etch
	Oxidation (High-voltage Gate Oxide)
	Photo-
Mask 5: Thin Gate oxide & VTP Adjust	Oxide Etch
	Oxidation (Thin Gate Oxide)
	Photo
	P-Type Implant (VTP Adjust)
Mask 6: Polysilicon Gate Patterning	Polysilicon Gate Deposition (CVD)
	Polysilicon Doping
	Photo
	Polysilicon Etch
Mask 7: P-Base	Photo
	P-Type Implant (P-Base)
Mask 10: N+ Implant	Oxidation and Diffusion
	Polysilicon Oxidation
	Photo
	N-Type Implant (N+)
Mask 11: P+ Implant	Photo
	P-Type Implant (P+)
Mask 12: Contacts	SG/PSG/SOG (Oxide) Deposition
	Diffusion
Γ	Photo
	Contact Etch
Mask 13: Metal 1	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
*	Photo
Γ	Metal Etch
[Dielectric and SOG (Oxide) Deposition
Mask 14: Vias	Photo
	Vias Etch
Mask 15: Metal 2	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
	Photo
	Metal Etch
	Oxide / Nitride Deposition
Mask 16: Passivation	Photo
<u> </u>	Oxide Etch

Name of Photolithographic Mask	Process Steps
Mask 1: N-Well	Starting Material : P- Bulk Silicon
	Oxidation (Initial oxide)
·	Photo
	N-Type Implant (N-Well)
	Diffusion
Mask 2: Active Area	Oxide Etch
·	Oxidation (Subnitox)
	Silicon Nitride Deposition (CVD)
	Photo
	Nitride Etch
Mask 3: P-Field	Photo
	P-Type Implant (P-Field)
	Blanket N-Type Implant (N-Field)
	Oxidation (Field Oxide)
	Nitride Etch
	Oxide Etch
	Oxidation (Pre-Gate Oxide)
Mask 4: High-voltage Gate Oxide	Oxide Etch
	Oxidation (High-voltage Gate Oxide)
	Photo
Mask 5: Thin Gate oxide & VTP Adjust	Oxide Etch
	Oxidation (Thin Gate Oxide)
	Photo
	P-Type Implant (VTP Adjust)
Mask 6: Polysilicon Gate Patterning	Polysilicon Gate Deposition (CVD)
Mask V. Polysilleon date latterning	Polysilicon Doping
	Photo
	Polysilicon Etch
Mask 7: P-Base	Photo
MASK Dase	P-Type Implant (P-Base)
Mask'8: N-Extended	Photo
MASA C. N. LA CARCAGO	N-Type Implant (N-Extended)
Mask 10: N+ Implant	Oxidation and Diffusion
Mask 10. N+ Implant	Polysilicon Oxidation
	Photo
,	N-Type Implant (N+)
Mask 11: P+ Implant	Photo
mask II. PT Implant	P-Type Implant (P+)
Mask 12: Contacts	SG/PSG/SOG (Oxide) Deposition
Mask 12. Contacts	Diffusion
	Photo
	Contact Etch
Mask 13: Metal 1	Ti/TiN Deposition with Oxidation
mask 13: Metal 1	Aluminium Alloy Deposition
	Photo
	Metal Etch
	Dielectric and SOG (Oxide) Deposition
	Photo
Mask 14: Vias	
	Vias Etch
Mask 15: Metal 2	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
	Photo
	Metal Etch
	Oxide / Nitride Deposition
Mask 16: Passivation	Photo
	Oxide Etch

Name of Photolithographic	Process Steps
	Process Sceps
Mask	
Mask 1: N-Well	Starting Material : P- Bulk Silicon
	Oxidation (Initial oxide)
	Photo
	N-Type Implant (N-Well)
	Diffusion
Mask 2: Active Area	Oxide Etch
	Oxidation (Subnitox)
	Silicon Nitride Deposition (CVD)
	Photo
	Nitride Etch
Mask 3: P-Field	Photo
	P-Type Implant (P-Field)
	Blanket N-Type Implant (N-Field)
	Oxidation (Field Oxide)
	Nitride Etch
	Oxide Etch
	Oxidation (Pre-Gate Oxide)
Mask 4 High-voltage Gate Oxide	Oxide Etch
	Oxidation (High-voltage Gate Oxide)
	Photo
Mask 5: Thin Gate oxide & VTP Adjust	Oxide Etch
·	Oxidation (Thin Gate Oxide)
	Photo
	P-Type Implant (VTP Adjust)
Mask 6: Polysilicon Gate Patterning	Polysilicon Gate Deposition (CVD)
	Polysilicon Doping
	Photo
	Polysilicon Etch
Mask 7: P-Base	Photo
	P-Type Implant (P-Base)
Mask 9 P-Top	Photo
	P-Type Implant (P-Top)
Mask 10: N+ Implant	Oxidation and Diffusion
	Polysilicon Oxidation
	Photo
	N-Type Implant (N+)
Mask 11: P+ Implant	Photo
-	P-Type Implant (P+)
Mask 12: Contacts	SG/PSG/SOG (Oxide) Deposition
	Diffusion
	Photo
	Contact Etch
Mask 13: Metal 1	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
	Photo
	Metal Etch
	Dielectric and SOG (Oxide) Deposition
Mask 14: Vias	Photo
	Vias Etch
Mask 15: Metal 2	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
	Photo
	Metal Etch
	Oxide / Nitride Deposition
Mask 16: Passivation	Photo
	Oxide Etch
	<u> </u>

Name of Photolithographic Mask	Process Steps
COLUMN TO THE PROPERTY OF THE	
Mask 1: N-Well	Starting Material : P- Bulk Silicon
	Oxidation (Initial oxide)
	Photo
	N-Type Implant (N-Well)
	Diffusion
Mask 2: Active Area	Oxide Etch
	Oxidation (Subnitox)
	Silicon Nitride Deposition (CVD)
	Photo
	Nitride Etch
Mask 3: P-Field	Photo
	P-Type Implant (P-Field)
	Blanket N-Type Implant (N-Field)
	Oxidation (Field Oxide)
	Nitride Etch
	Oxide Etch
	Oxidation (Pre-Gate Oxide)
Mask 4: High-voltage Gate Oxide	Oxide Etch
	Oxidation (High-voltage Gate Oxide)
AND AND A STATE OF THE STATE OF	Photo
Mask 5: Thin Gate oxide & VTP Adjust	Oxide Etch
	Oxidation (Thin Gate Oxide)
	Photo
	P-Type Implant (VTP Adjust)
Mask 6: Polysilicon Gate Patterning	Polysilicon Gate Deposition (CVD)
mon o. rollollion once landelling	Polysilicon Doping
	Photo
	Polysilicon Etch
Mask 7: P-Base	Photo
MASK 1, 2 Dase	P-Type Implant (P-Base)
Mask 8: N-Extended	Photo
MASK G. R-EACEIREG	N-Type Implant (N-Extended)
M-32 0 5 m-4	Photo
Mask 9: P-Top	
	P-Type Implant (P-Top)
Mask 10: N+ Implant	Oxidation and Diffusion
	Polysilicon Oxidation
•	Photo
	N-Type Implant (N+)
Mask 11: P+ Implant	Photo
	P-Type Implant (P+)
Mask 12: Contacts	SG/PSG/SOG (Oxide) Deposition
	Diffusion
	Photo
	Contact Etch
Mask 13: Metal 1	Ti/TiN Deposition with Oxidation
	Aluminium Alloy Deposition
	Photo
	Metal Etch
	Dielectric and SOG (Oxide) Deposition
	Photo
Mask 14: Vias	
Mask 14: Vias	Vias Etch
Mask 14: Vias Mask 15: Metal 2	Vias Etch Ti/TiN Deposition with Oxidation Aluminium Alloy Deposition
	Ti/TiN Deposition with Oxidation Aluminium Alloy Deposition
	Ti/TiN Deposition with Oxidation Aluminium Alloy Deposition Photo
	Ti/TiN Deposition with Oxidation Aluminium Alloy Deposition Photo Metal Etch
Mask 15: Metal 2	Ti/TiN Deposition with Oxidation Aluminium Alloy Deposition Photo Metal Etch Oxide / Nitride Deposition
	Ti/TiN Deposition with Oxidation Aluminium Alloy Deposition Photo Metal Etch

Figure 19a

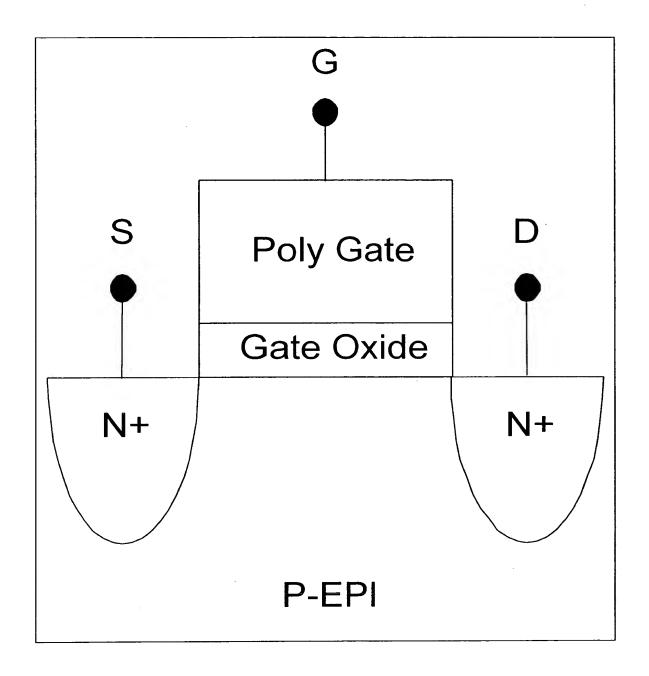


Figure 19b

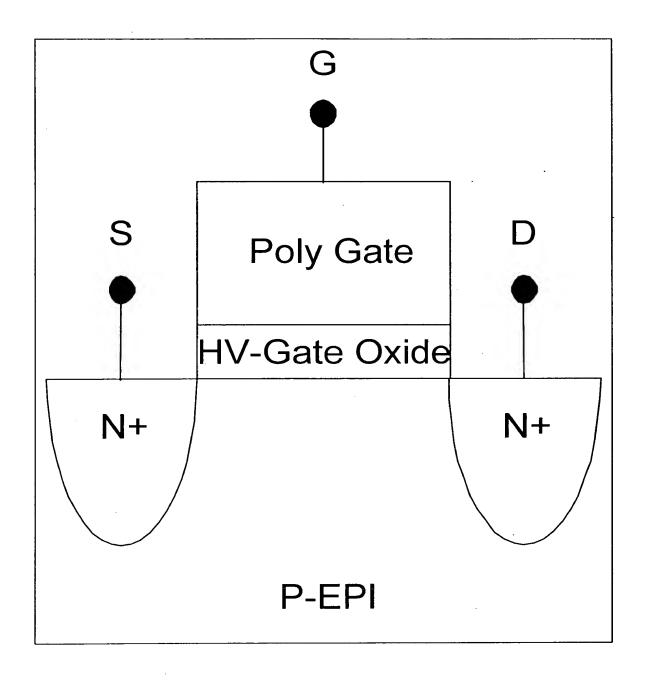


Figure 20a

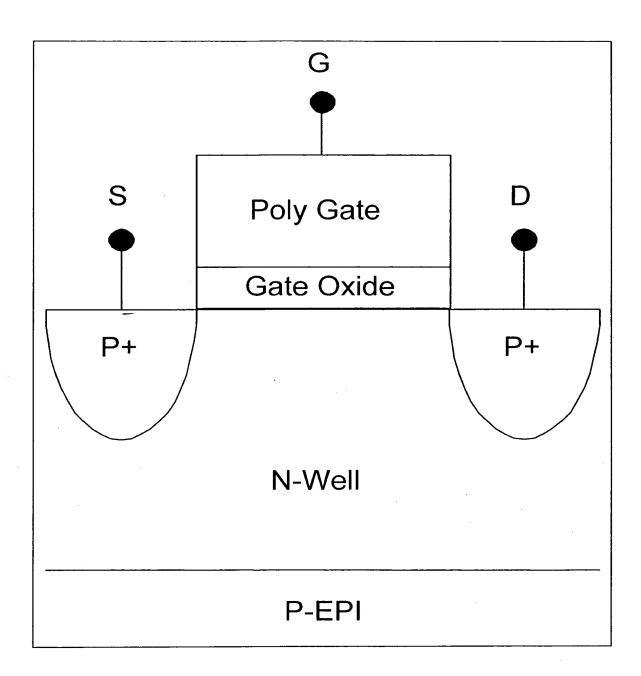






Figure 20b

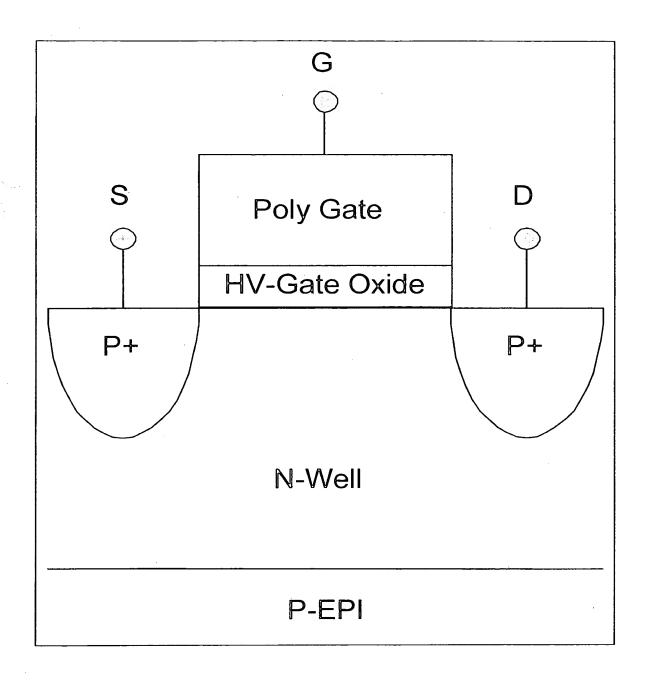


Figure 21a

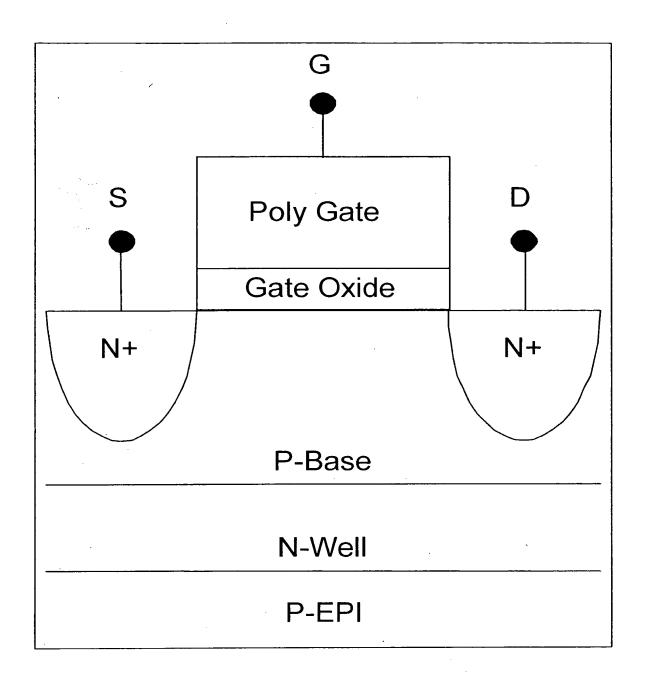


Figure 21b

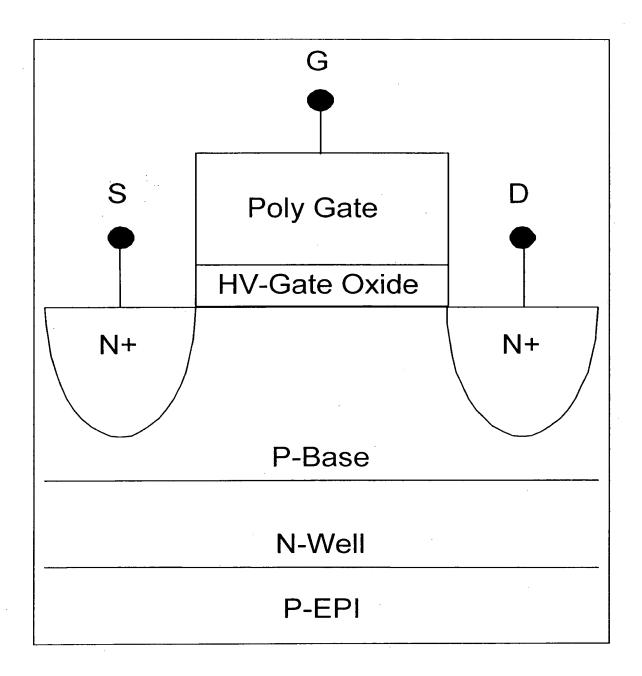


Figure 22a

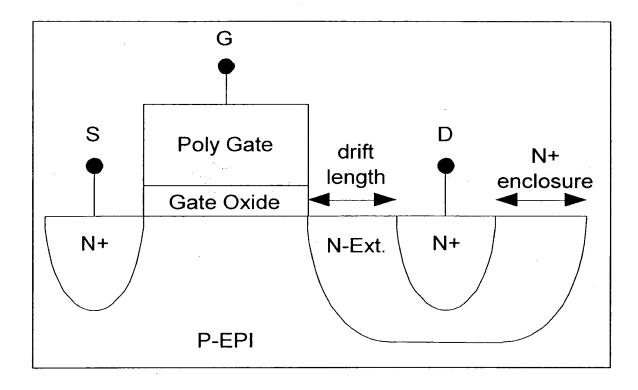


Figure 22b

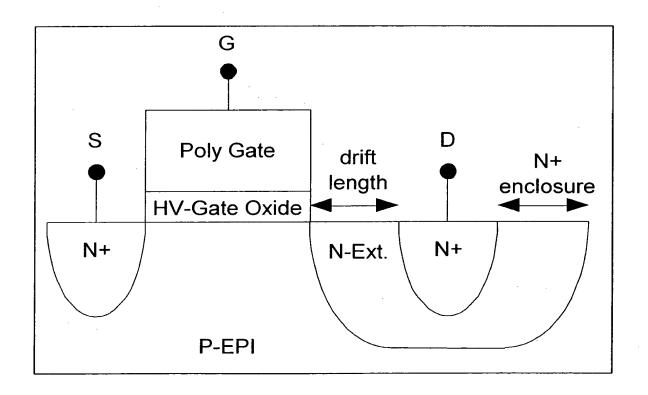


Figure 23a

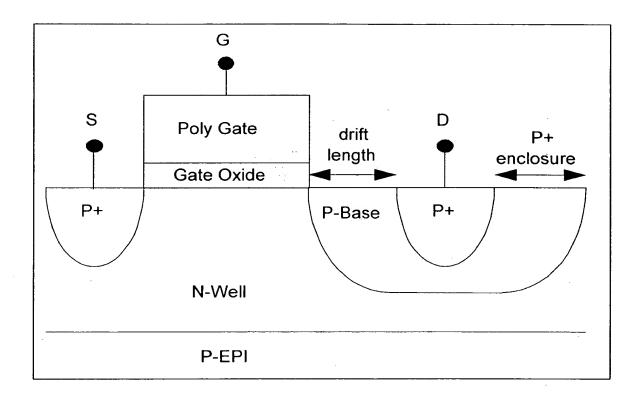


Figure 23b

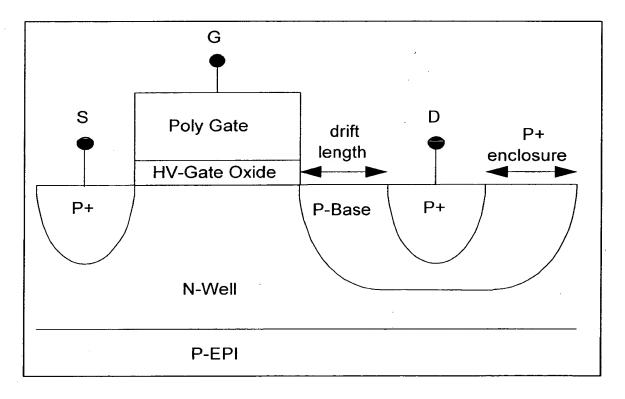


Figure 24a

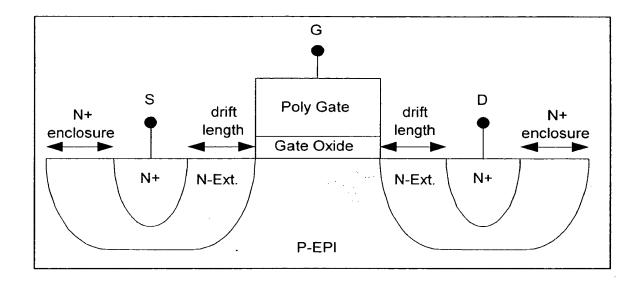


Figure 24b

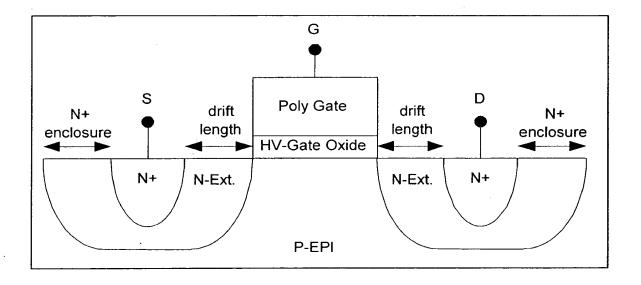


Figure 25a

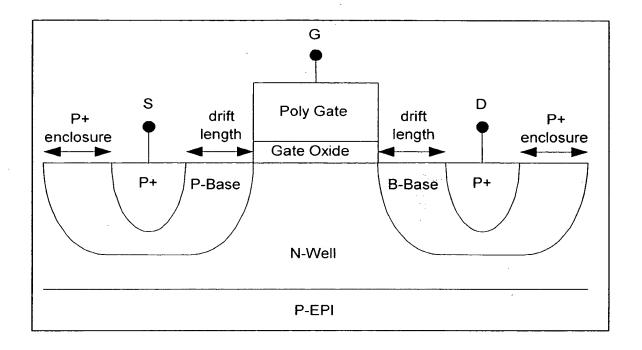


Figure 25b

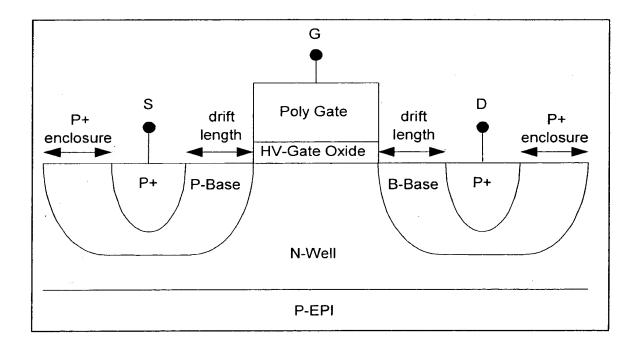


Figure 26a

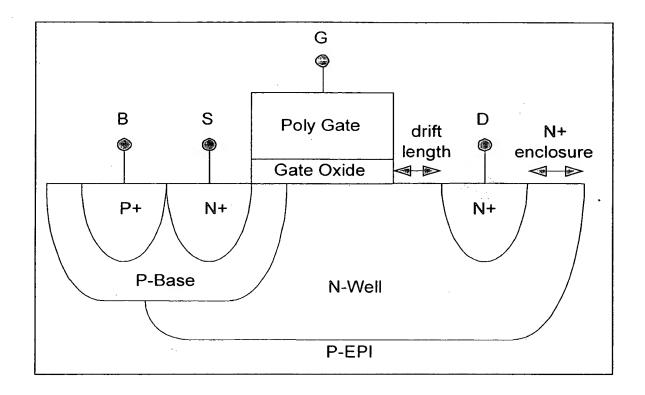


Figure 26b

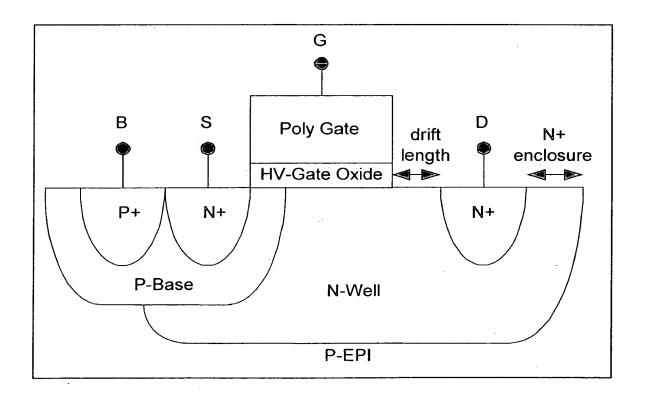


Figure 27a

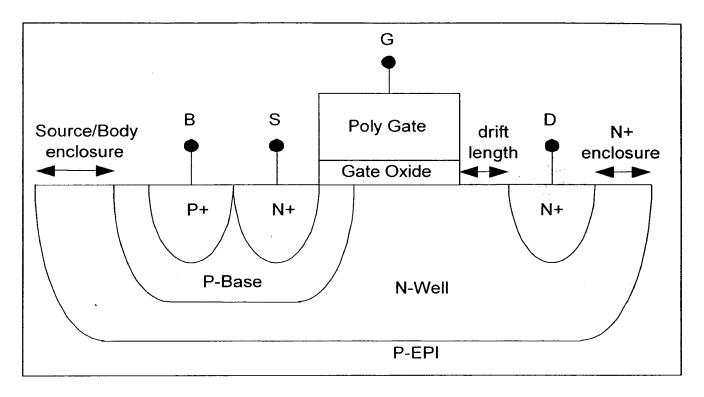


Figure 27b

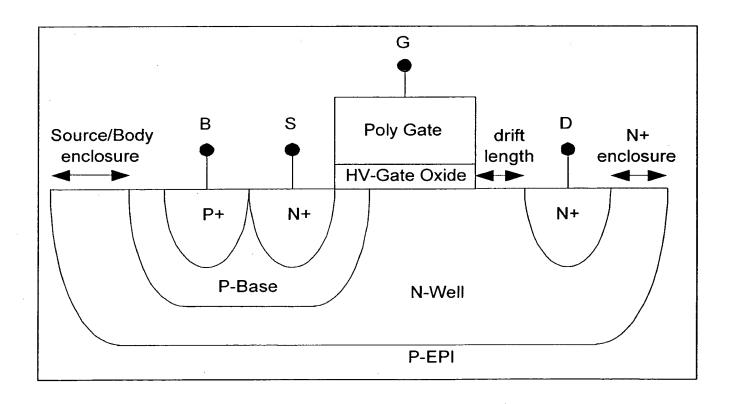


Figure 28a

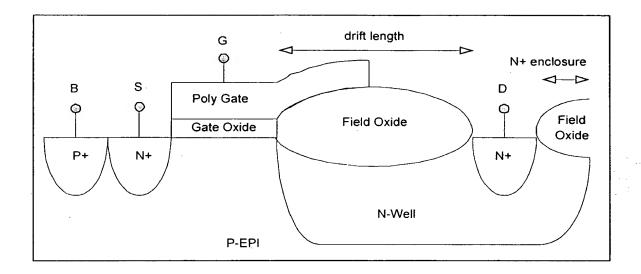


Figure 28b

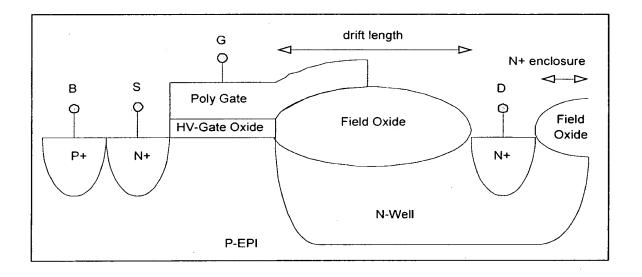


Figure 29a

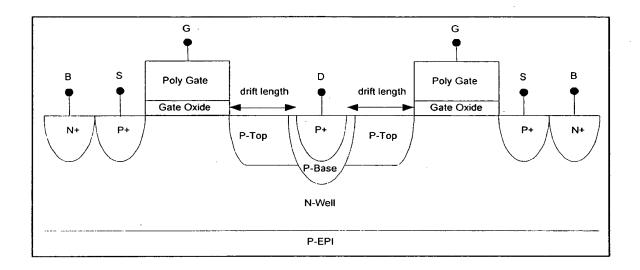


Figure 29b

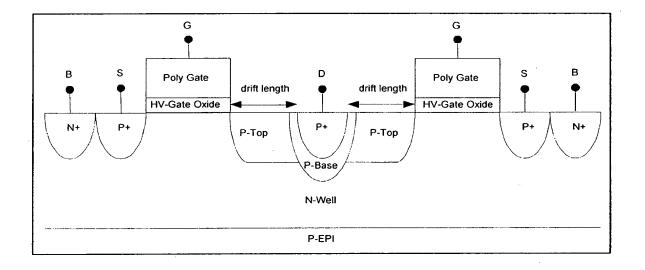


Figure 30a

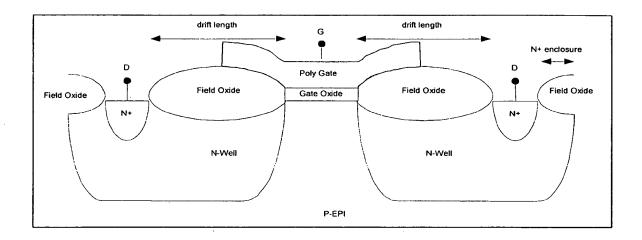


Figure 30b

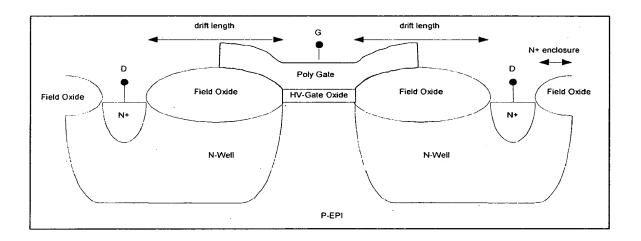


Figure 31a

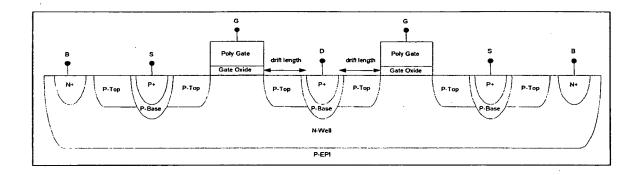


Figure 31b

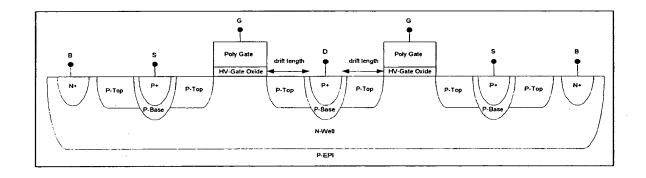


Figure 32a

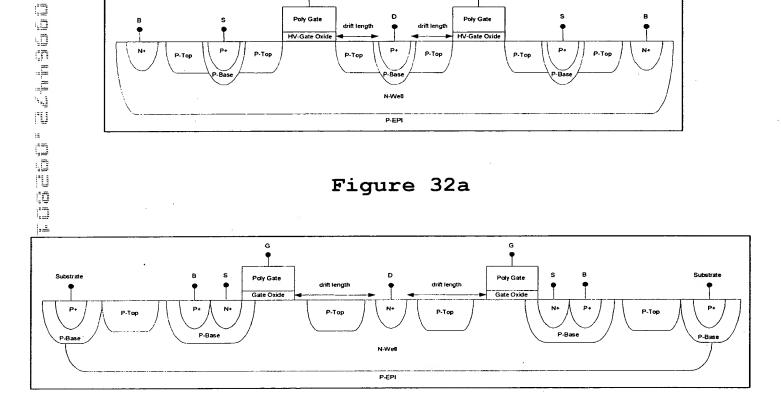


Figure 32b

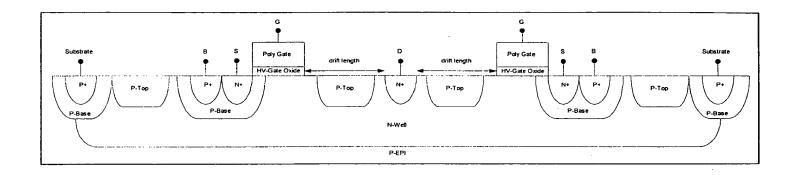


Figure 33a

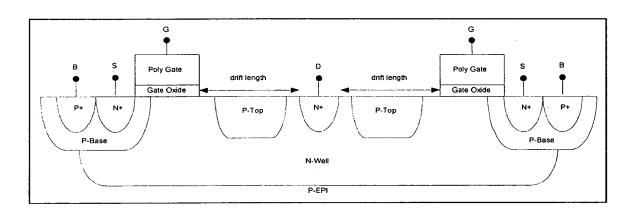
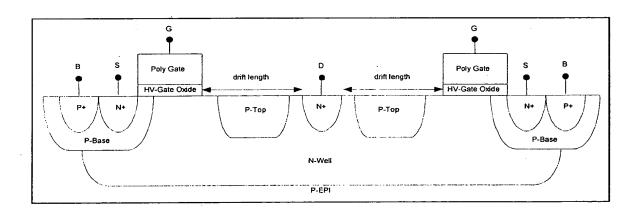


Figure 33b



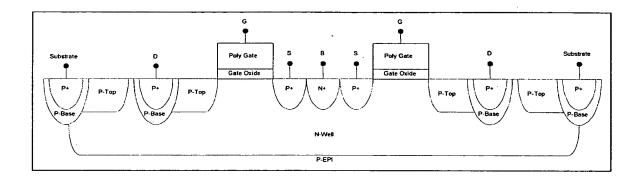


Figure 34b

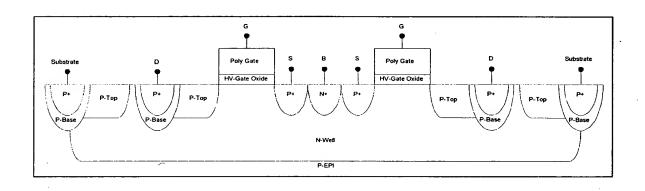


Figure 35a

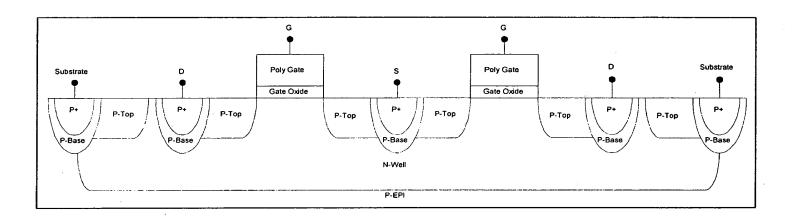


Figure 35b

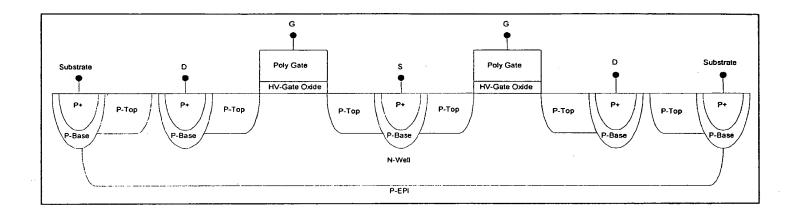


Figure 36

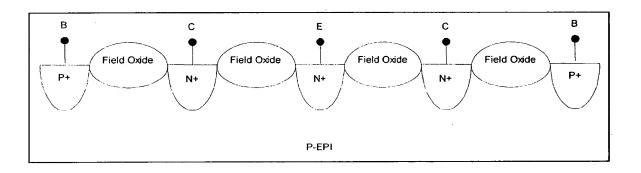
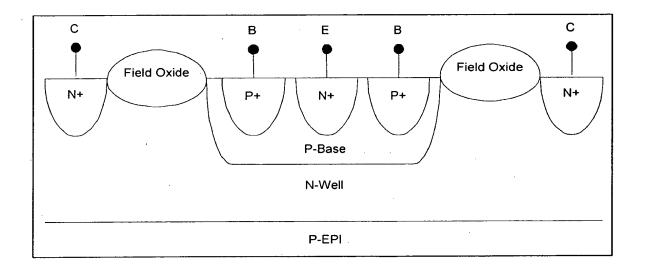


Figure 37



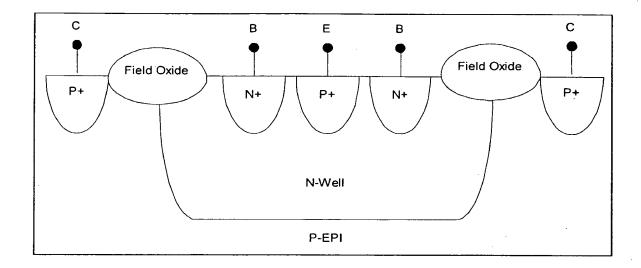


Figure 39

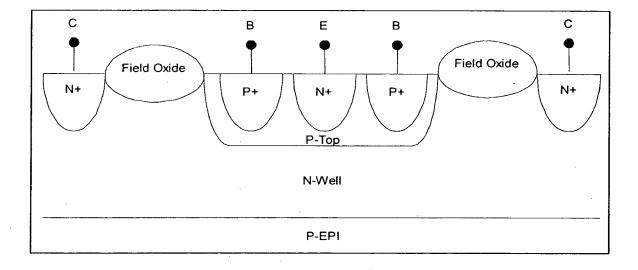


Figure 40

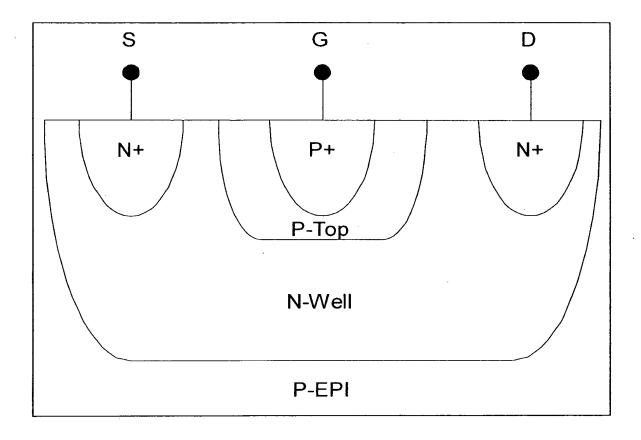


Figure 41a

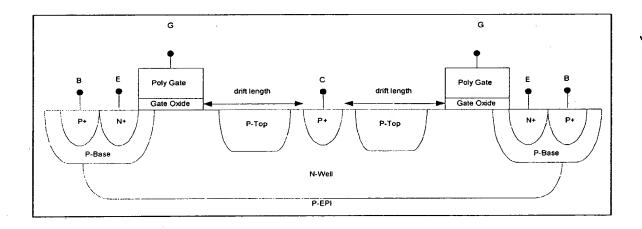
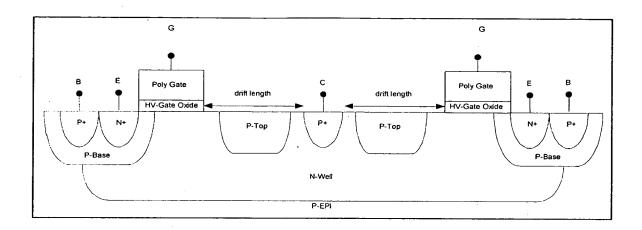


Figure 41b



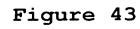
		Active Component	Gate	Drain
		7	oltage	(V)Voltage (V)
_				
	The	standard N-MOSFET of Figure 19a	15	5.5
	The	standard N-MOSFET of Figure 19b	40	5.5
	The	standard P-MOSFET of Figure 20a	15	5.5
	The	standard P-MOSFET of Figure 20b	40	5.5
	The	standard Junction isolated N-MOSFET of Figure	21a 15	5.5
	The	standard Junction isolated N-MOSFET of Figure	21b 40	5.5
	The	mid-voltage single extended N-MOSFET of Figure	e 22a15	40
	The	mid-voltage single extended N-MOSFET of Figure	e 22b40	40
	The	mid-voltage single extended P-MOSFET of Figure	e 23a15	40
	The	mid-voltage single extended P-MOSFET of Figure	e 23b40	40
	The	mid-voltage double extended N-MOSFET of Figure	e 24a15	40
	The	mid-voltage double extended N-MOSFET of Figure	e 24b40	40
	The	mid-voltage double extended P-MOSFET of Figure	e 25a15	40
	The	mid-voltage double extended P-MOSFET of Figure	e 25b40	40
	The	mid-voltage single extended N-LDMOSFET of Fig	ure 26a	15 75
	The	mid-voltage single extended N-LDMOSFET of Fig	ure 26b	40 75
	The	$\label{eq:mid-voltage} \mbox{ mid-voltage floating source N-LDMOSFET of } \textbf{Fig}$	ure 27a	15 75

Maximum

Maximum

The standard Ju The mid-voltage floating source N-LDMOSFET of Figure 27b 40 75 The high-voltage single extended N-MOSFET of Figure 28a 15 The high-voltage single extended N-MOSFET of Figure 28b 40 100 The high-voltage single extended P-MOSFET of Figure 29a The high-voltage single extended P-MOSFET of Figure 29b 40 100 The high-voltage double extended N-MOSFET of Figure 30a The high-voltage double extended N-MOSFET of Figure 30b 40 The high-voltage double extended P-MOSFET of Figure 31a 15 100 The high-voltage double extended P-MOSFET of Figure 31b 40 100 The high-voltage double extended N-LDMOSFET of Figure 32a 15 The high-voltage double extended N-LDMOSFET of Figure 32b 40 The very-high-voltage single extended N-LDMOSFET of Figure 33a 15 The very-high-voltage single extended N-LDMOSFET of Figure 33b 40 The very-high-voltage single extended P-MOSFET of Figure 34a 15 The very-high-voltage single extended P-MOSFET of Figure 34b 40 The very-high-voltage double extended P-MOSFET of Figure 35a 325

The 325	very-high-voltage double extended P-MOSFET of	Figure 35b	40	
The	lateral NPN bipolar transistor of Figure 36		15 ,	
The	high-voltage vertical NPN bipolar transistor o	f Figure 37	- 4	40
	high-voltage vertical PNP bipolar transistor o		- 5	5 5
The	very-high-gain vertical NPN bipolar transistor	of Figure 39	-	
3.3				
The	high-voltage N-JFET of Figure 40	600	600	
The	very high-voltage LIGBT of Figure 41a	15	600	
The	very high-voltage LIGBT of Figure 41b	40	600	



Junction	Typical Sheet Resistance	Typical Breakdown
Tale .		Voltage
P+ / N-Well	65 Ohms/sq.	20 Volts
N+ / P-Substrate	50 Ohms/sq.	. 25 Volts
P-Top / N-Well	14 kOhms/sq.	40 Volts
P-Base / N-well	1.75 kOhms/sq.	45 Volts
N-Ext. / P-Substrate	4 kOhms/sq.	45 Volts
N-Well / P-Substrate	1.5 kOhms/sq.	150 Volts
N-Well / P-Top / P-Substrate (RESURF)	-	650 Volts